me that the fungus of the green muscardine approaches in every respect the genus *Isaria*, the name *Metarhizium* became useless, the more so because the other representatives of this genus were imperfectly established. The fungus of the green muscardine has, besides, the typical aspect of an arborescent *Isaria* upon the larvæ of *Cleonus punctiventris* when placed in moist sand. In artificial cultures *Isaria destructor* is known besides under the form *Coremium*.

The ingenious names which Lebert has given to different forms of entomogenous fungi, such as *Verticillium*, *Polistophthora*, *Acanthomyces*, etc., by no means represent new forms but are only synonyms for *Cordyceps* and *Isaria*.

It remains to be seen in how many cases muscardine parasites of insects can develop under artificial conditions. It is said that experiments were made upon twenty-four different species of insects and always gave favorable results. Besides these, there were four other cases of contagion, which, although observed under artificial conditions (not in open air), did not arise from spores sown intentionally.

In these latter cases the parasite developed upon insects inclosed in bottles or boxes. It is interesting to note that in almost every case artificial infections are due to fungi of the genera *Isaria* and *Botrytis;* that is to say, to fungi whose artificial cultures succeed marvelously.

On the contrary, infections with the genera *Cordyceps* and *Entomophthora* are more restricted in number. Up to the present time artificial cultures of these genera have not succeeded at all. For the genus *Cordyceps* we have but one experiment by De Bary and for *Entomophthora* three experiments by Brefeld. No experiments have been attempted with *Stilbum*, but judging from the structure of the fungus, so like that of *Isaria*, it appears probable that artificial cultures and infections will succeed as well with it as with *Isaria*. With *Tarichium* all attempts of contagion have failed completely, and consequently artificial culture is shown to be impossible.

If later researches confirm the cycle of development of *Tarichium uvella*, and if the complete development of other representatives of this genus can be obtained in artificial cultures, it will then be possible to attempt infection with spores artificially produced. As has been indicated, the ordinary spores of *Tarichium* will never produce contagion when placed in contact with the bodies of insects.—EFFIE A. SOUTHWORTH.

HARTIG, Dr. ROBERT. *Lehrbuch der Baumkrankheiten.* Zweite verbesserte und vermehrte Auflage. Mit 137 Text-Abbildungen und einer Tafel in Farbendruck. Berlin. Verlag von Julius Springer, 1889. 8vo, cloth, pp. 291.

The second edition of Dr. Hartig's *Lehrbuch* embodies much interesting information in a convenient form and can not fail to meet with the same favorable reception as the first edition published in 1882.

Only one lithographic table has been introduced and an effort has been made to simplify the text as much as possible. What is here omitted the specialist will find in original papers, which in any event he would desire to consult, and the general reader will welcome the clear style and freedom from technical description. The individuality of the author is visible everywhere. He has copied no one, not even in the matter of wood-cuts and the result is an exceedingly interesting and useful book.

The introduction discusses briefly:

(1) The development of the doctrine of plant diseases (commencing with Schreger, 1795); (2) Causes of disease; (3) Methods of investigation.

The body of the work is divided into four sections: (1) Injuries by plants; (2) wounds, *i. e.*, mechanical injuries; (3) sickenings through influence of the soil; (4) sickenings through atmospheric influences. The first section contains 175 pages, the greater part of which is devoted to parasitic fungi. The treatment of this subject is somewhat broader than the title of the book would indicate, brief mention being made of diseases attacking grains, vegetables, and other herbaceous plants.

The author is most at home upon the wood-infesting and tree-destroying species, to which he has devoted many years of profound and painstaking inquiry. The following *Hymenomycetes* are described as destructive to living wood: *Trametes radiciperda, T. pini; Polyporus fulvus, P. borealis, P. vaporarius, P. mollis, P. sulphureus, P. igniarius, P. dryadeus; Hydnum diversidens; Telephora Perdix; Stereum hirsutum,* and *Agaricus melleus.* Mention is also made of *Polyporus fomentarius, P. betulinus, P. lævigatus,* and *P. Schweinitzii,* and the author believes that numerous other *Polypori* not yet critically investigated live as parasites in the wood of trees. *Dœdalea quercina* and *Fistulina hepatica* are also probably parasitic, at least the former.

The destruction of timber receives considerable attention. There is a "dry rot" due to various fungi, the spores of which often find their way into cracks on the surface of logs while lying in the forest. These spores germinate the following summer while the logs are at the mill, if the heat and moisture are sufficient. The first symptom is a red-striping of the timber. The loss from this cause in the Bavarian forest is stated to be 33 per cent. of the entire product. The most vexatious timber-destroyer appears, however, to be the house fungus *Merulius lacrymans.* This attacks and destroys low lying or damp portions of buildings, and is peculiarly a plant associated with men, although it sometimes occurs in the forest. The extremely minute spores, about four million of which could be packed in the space of a cubic millimeter, germinate only in presence of some alkali, and this is thought to be the explanation of the fact that the fungus is most likely to appear in parts of buildings wet by urine, ashes, etc. When fresh, this fungus

has a very agreeable smell and a fine taste, afterward somewhat astringent. The mycelium excretes large quantities of water and keeps dwelling rooms excessively damp. In decay, the sporophores produce a very characteristic disagreeable odor, which is undoubtedly prejudicial to health. Infection may take place either through mycelium or spores. The latter are often carried from place to place on clothing, tools, etc., which have been used by workmen, especially carpenters, in repairing decayed buildings.

The book seems to have been very carefully prepared, but some omissions are noteworthy, and occasionally one meets a questionable statement.

Under *Gymnosporangium* four species are mentioned—*G. conicum* (*juniperinum*), *clavariæforme*, *Sabinæ* (*fuscum*), and *tremelloides*. The author thinks a further investigation of the forms thus far known and described is desirable, as the results of some experiments instituted by him do not agree with those commonly accepted. No mention is made of the labors of Dr. Farlow or of Dr. Thaxter.

Under bacteria Dr. Hartig urges the commonly accepted view that the acid reaction of most plants is unfavorable to their growth and development, and evidently thinks they play a very unimportant rôle in the production of plant diseases. They have been found as parasites, he says, only in thin-walled, soft parenchymatous tissue, such as bulbs and tubers, and here are often preceded by fungi. Even in Waacker's hyacinth disease (the yellow, slimy bacteriosis) "the bacteria do not attack entirely sound, well-ripened bulbs under normal conditions," but only those that have been wounded or previously attacked by fungi, especially by a hyphomycetous fungus, which is almost always associated with this bacteriosis. In damp places the bacteria enter the wounds and cause the rot. The following paragraph on pear blight will hardly pass muster, and was certainly not to be expected in a handbook published in 1889. All the recent American publications on this subject, especially the papers by Dr. Arthur, appear to have escaped the author's attention.

> Recently a disease of pear and apple trees, called blight, has been described by J. Burrill in Urbana, Ill., the cause of which this investigator ascribes to the invasion of a bacterium. The disease appears to bear a resemblance to the tree canker (*Baumkrebs*) caused by *Nectria ditissima*, and since in this fungus small bacteria-like gonidia are produced in great numbers in the bark, it becomes necessary to inquire first of all whether this disease has not been wrongly ascribed to a schizomycete.

Mention is made of fifteen species of *Exoascus*, all of which produce characteristic hypertrophies. Seven of these species also cause *hexenbesen* or witchbrooms, and these peculiar growths are also induced by various *Uredineæ*, notably by the æcidium (*Peridermium pini*) of *Coleosporium senecionis*, and by *Æcidium* (*Peridermium*) *elatinum*.

The black-knot of the plum and cherry, *Plowrightia morbosa*, is said to occur only in North America, but the author thinks it may be in-

troduced into Europe at any time. This is quite likely and the wonder is that it should not have occurred before, owing to the fact that it is found on all our species of *Prunus* and is very destructive in many parts of the eastern United States.

The volume ends with a brief index, preceded by a convenient synopsis of diseases (215 in number). This is arranged alphabetically according to hosts, and under each host according to organs, so that the reader who knows the name of the host and of the part attacked can quickly refer to the description of the disease in the body of the text.—ERWIN F. SMITH.

KELLERMAN & SWINGLE. *Branch Knot of the Hackberry.* Report of Botanical Department, in First Annual Report of the Kansas Experiment Station, 1888.

This article is especially interesting to lovers of fungi from the fact that it relates to the peculiar double effect of plant parasite and insect irritation upon the same portion of host tissue. The infecting fungus *Sphærotheca phytoptophila*, Kell. & Sw., appears to be a new and quite distinct species, choosing as its home the peculiar formations caused by a *Phytoptus* or gall mite, which remains as yet undescribed. Many small branches of the hackberry (*Celtis occidentalis*, L.) have upon them knots and clusters of small abnormal twigs, which were supposed to be wholly due to the attacks of insects until the authors of this paper in March, 1888, discovered the mycelium and fruiting bodies of this new powdery mildew growing upon the buds and stems of the diseased portions. Up to this time only two species of the *Erysipheæ* had been found growing upon the *Celtis*, both of which belong to the genus *Uncinula*, and only one as an inhabitant of Phytoptus galls—a *Microsphæra*. A portion of the article is taken up with a description of the curious distortions caused by the gall mite and mildew combined, two photo-lithographs of different styles or types being added. Following this is a short account of the general characters of the *Erysipheæ* and a very full and carefully prepared description of the species in question. The presence of *Cicinnobolus Cesatii*, DBy., the common parasite of the powdery mildews, is noted, and shares with the gall-mite a short description. As remedies for this complex disease, which disfigures and enfeebles the hackberry trees—used quite frequently for ornamentation in the West—the authors suggest the use of sulphur and its compounds along with that most effective of preventive measures, a removal and destruction of the diseased portions during the winter season.

Whether or not the fungus and gall-mite are independent of each other the paper does not attempt to decide, but leaves the matter for further experimentation, throwing out the suggestion that it may be possible for the mite to form galls without the fungus, but not for the fungus to live separated from the gall.—D. G. FAIRCHILD.